

Hawksbill Sea Turtles in the Northwestern Hawaiian Islands

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ABSTRACT. – This study reports observations of Hawksbill sea turtles (*Eretmochelys imbricata*) in the Northwestern Hawaiian Islands, a remote and protected expanse of coral atolls considered outside the species range. Since no direct monitoring efforts exist, we synthesized records from historical accounts, opportunistic sightings, and internet crowdsourcing. We found 6 definitive hawksbill observations and 3 additional potential nesting records, documenting that hawksbills currently reside in the Northwestern Hawaiian Islands and suggesting that they occurred there in greater numbers historically.

Globally, hawksbill sea turtles are listed as Endangered on the US Endangered Species Act and Critically Endangered by the International Union for Conservation of Nature (IUCN) as populations have declined > 84% since 1900 (Mortimer and Donnelly 2008). Persistent exploitation for the tortoiseshell trade was the major historical population threat (Groombridge and Luxmore 1989; Van Dijk and Shepherd 2004; Limpus and Miller 2008). While such trade remains a significant conservation concern today (Mortimer and Donnelly 2008; Rice and Moore 2008), other threats are less documented. Hawksbills are reportedly toxic in the Pacific Islands and less frequently harvested for food (McClenachan et al. 2006; Fussly et al. 2007; Buden 2011), they are uncommonly recorded as commercial fisheries bycatch (Lewison et al. 2004), and the direct effects of climate and climate change are not well understood (Hawkes et al. 2009; Van Houtan and Halley 2011; Monte-Luna et al. 2012). Urbanization and coastal development adjacent to nesting beaches, egg collection, and bycatch in artisanal

fisheries are also known as serious threats (Mortimer and Donnelly 2008; Liles et al. 2011). Of further concern, coral reef ecosystems—a major habitat for hawksbills in much of their range—are in worldwide decline (Jackson 1997; Wulff 2006; Hoegh-Guldberg et al. 2007).

Hawaiian hawksbills are one of the smallest distinct populations (Bowen and Karl 2007; Wallace et al. 2010) of sea turtles on Earth yet their occurrence and abundance are not well known. Existing information suggests the population was always rare and restricted to the main Hawaiian Islands. Bryan, for example, in his natural history of Hawaii wrote: “The most abundant species about Hawaii is the green turtle... [its scutes] never overlap, as they do on the rarer hawksbill turtle or *e-a*, which furnishes the tortoise-shell of commerce” (Bryan 1915). From separate 1960s expeditions to Pearl and Hermes Reef and French Frigate Shoals in the Northwestern Hawaiian Islands (NWHI), Amerson observed: “Possibly the Pacific Hawksbill Turtle... an uncommon species in the Hawaiian Islands, has visited the atoll, but no records exist of its occurrence” (Amerson 1971; Amerson et al. 1974). From a review of the literature and his own 1970s research, Balazs wrote: “the hawksbill is only known to occur in small numbers exclusively at the southeastern end of the Hawaiian Archipelago” (Balazs 1980). More recently, Parker and colleagues stated: “Hawksbill turtles do not currently nest or reside in the Northwestern Hawaiian Islands” (Parker et al. 2009).

Besides rarity, a lack of records may reflect inadequate monitoring. The most extensive hawksbill surveys are nest-monitoring programs in the main Hawaiian Islands on the islands of Hawaii and Maui. These efforts have never totaled more than 20 nesting females a year (Hutchinson et al. 2008; Seitz et al. 2012). In-water hawksbill surveys are infrequent. The Hawaii Wildlife Fund periodically surveys the waters off Maui and Kahoolawe and the Pacific Islands Fisheries Science Center (PIFSC) of the US National Marine Fisheries Service (NMFS) only occasionally encounters hawksbills during surveys for green turtles (Balazs and Chaloupka 2004) and as strandings (Van Houtan et al. 2010) in the main Hawaiian Islands. In the NWHI, no monitoring efforts exist.

Methods. — Here we report hawksbill observations in the NWHI, a 2000-km-long expanse of relatively intact coral atolls, isolated from human populations and protected as the Papahānaumokuākea Marine National Monument (Selkoe et al. 2009). We researched a variety of sources from institutional archives to internet databases, relying on a diversity of data to assess the historical and current biogeographic distribution of Hawaiian hawksbills. We searched archival holdings in Hawaii at: University of Hawaii-Manoa Hamilton Library, Bernice P. Bishop Museum, Hawaii State Archives, Hawaiian Historical Society, Mission House Museum, University of

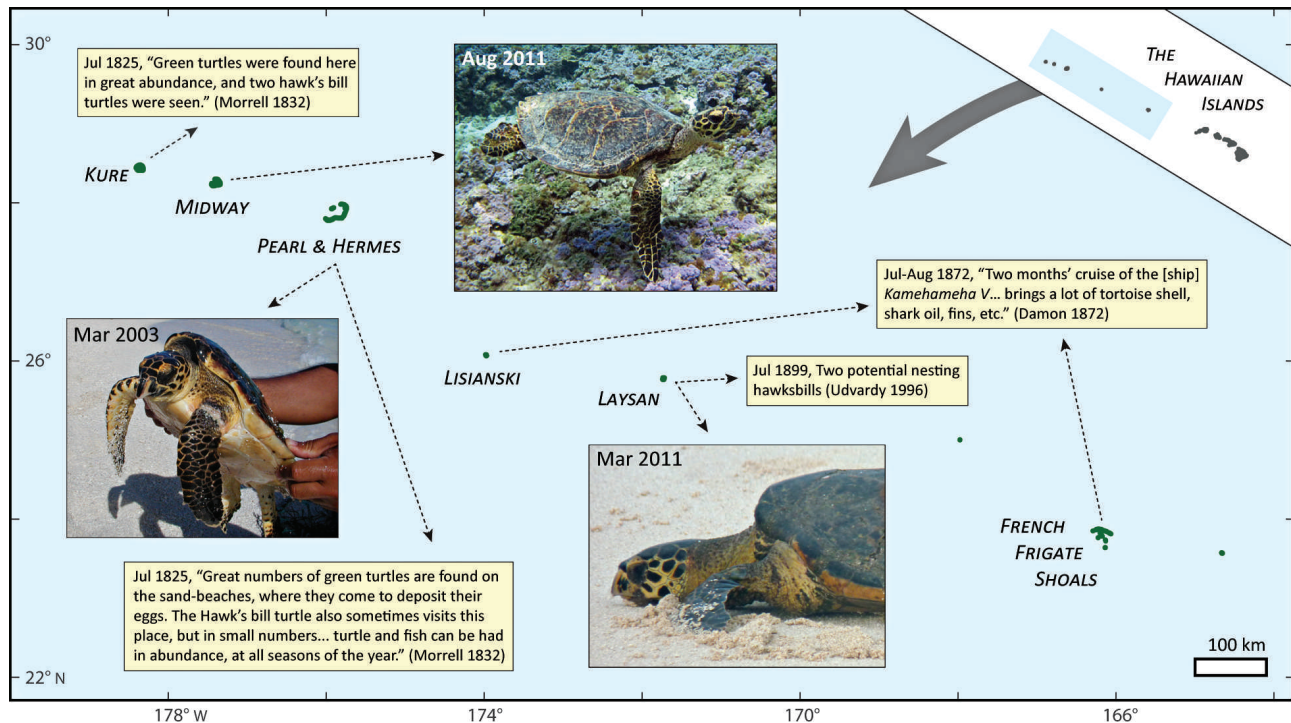


Figure 1. Historical and recent hawksbill records in the northwestern Hawaiian Islands (NWHI). Observations are mapped to their locations with details provided. Of the historical records, the harvest of tortoiseshell in 1872 suggests a significantly larger population than exists today. Of the 3 records since 2000, all were juveniles. Two of these records (Laysan, Pearl & Hermes) were of stranded turtles that were examined, treated, and released. Due to the remoteness of the area, there are no dedicated in-water surveys for hawksbill sea turtles in the NWHI. These logistical constraints contribute to the lack of data records. Photo credits, clockwise from top: Ray Born (USFWS), Adam Fox (JIMAR/NOAA), Jason Baker (NOAA).

Hawaii-Hilo Mookini Library, and NOAA-PIFSC library. We also researched special collections, including: Thrum's *Hawaiian Almanac and Annual* series, the Smithsonian Institution's *Atoll Research Bulletin* series, the 8-volume *American Activities in the Central Pacific 1790–1870* (Ward 1966), Hawaiian newspapers, and other archival sources. In addition, we researched online databases such as Google Books, Project Gutenberg, Flickr, Picasa, and others—and initiated an open call for observations through a project at www.iNaturalist.org.

Historical data sources, while limited in precision, can provide important and scientifically valid information on the distribution and abundance of species prior to the advent of modern ecology (Jackson et al. 2001; Pandolfi et al. 2003; Lotze et al. 2006). Such approaches have been used to assess population changes of marine megafauna (McClenachan et al. 2006) and to reconstruct long-term ecosystem trends (Pandolfi et al. 2003; Kittinger et al. 2011). The information gathered here range from historical and anecdotal observations to photographs to modern scientific data and is part of a larger project to document the historical ecology of sea turtles in the Pacific Ocean.

Results and Discussion. — Figure 1 summarizes 6 documented hawksbill observations and 2 additional potential nesting records in the NWHI. Five of these

records date to the 1800s, with 3 occurring since 2003. We provide details below.

In an 1825 cruise to the NWHI, Morrell observed hawksbills at both Kure Atoll and at Pearl and Hermes Atoll (Morrell 1832). On 8 July at Pearl and Hermes he wrote, "Great numbers of green turtles are found on the sand-beaches, where they come to deposit their eggs. The Hawk's bill turtle also sometimes visits this place, but in small numbers... turtle and fish can be had in abundance, at all seasons of the year." Four days later at Kure he recorded, "Green turtles were found here in great abundance, and two hawk's bill turtles were seen." Morrell's ability to distinguish between green and hawksbill turtles is uncommon in the many observations we collected of turtles in the NWHI that date to the 19th century. Fifty years later, in 1872, a newspaper reported a sizeable tortoiseshell haul from a 2-mo cruise to French Frigate Shoals and Lisianski Island: "The [ship] *Kamehameha V...* brings a lot of tortoise shell, shark oil, fins, etc." (Damon 1872). Though the precise quantity of shell here is unknown, as a reference, 1 m³ of hawksbill stacked scutes requires at least 500 individuals (K. Van Houtan, unpubl. data, 2012) assuming a population of mixed age classes. These observations indicate hawksbills resided in the NWHI in the 1800s—and as it is accepted that historical references to tortoiseshell are to hawksbills (McClenachan et al. 2006)—perhaps even in significant numbers.

Historical references to nesting are ambiguous. In the summer of 1899, Schauinsland's notes (Udvardy 1996) from Laysan resemble hawksbills. Hunting turtles on the beaches, he wrote: "Once turned onto its back the turtle was completely helpless (except for its giant parrot-beak which we had to watch not to approach too closely)." Unlike the more abundant green turtle (*Chelonia mydas*), the hawksbill has an unmistakably narrowed, parrot-like beak (Donohue 2003) akin to this description (Fig. 1). Schauinsland later observed: "One day we caught a turtle containing in its innards several hundred ball-shaped eggs, covered with a white flexible membrane, about the size of those of the domestic hen." The crew carefully buried these eggs and later witnessed live hatchlings emerge from their makeshift nest. As hawksbills (average 175 eggs) have significantly larger clutches than green turtles (average 92 eggs) in Hawaii (Niethammer et al. 1997; Seitz et al. 2012) this record may suggest a nesting hawksbill. Furthermore, Morell's above note from Pearl and Hermes could also be read as a nesting description. Though these observations are uncertain, they are noteworthy as indicating hawksbills may have nested in the NWHI.

Three confirmed photographic records in the last decade indicate juvenile hawksbills are currently found in the NWHI. In July 2003 at Pearl and Hermes, 2 NMFS scientists collecting marine debris disentangled a 35-cm-long (straight carapace length) juvenile hawksbill from a trawl net. Save a flipper wound (Fig. 1) the turtle appeared healthy, was released, and swam away (Donohue 2003). Given its size and condition, the turtle was most likely entangled within or near the atoll, and certainly within the NWHI. In March 2011 on Laysan Island NMFS employees discovered a 46-cm-long hawksbill stranded 75 m inland after the Tōhoku tsunami. The researchers carried the turtle to the beach, where it crawled to the surf and swam away. On August 2011 at Midway Atoll, researchers on a snorkeling survey for *Pinctada* oysters photographed a ca. 45-cm-long juvenile at 2 m of depth on the eastern backreef. Though we cannot be certain without genetic confirmation, proximity suggests these turtles came from the Hawaiian population because the next-nearest known nesting area is American Samoa (Hutchinson et al. 2008) 4 times the distance (4400 km) away.

These data likely underreport the occurrence and abundance of hawksbills in the NWHI for at least 3 reasons. First, historical references to turtles were typically not made by naturalists trained in identification. Most often, a reference generically states "turtles abound" with no further details. Second, the historical record documents extensive and persistent turtle harvests throughout the NWHI. Before 1900 every ship reportedly killed turtles (Elschner 1915) and some even took hundreds a day (Ely and Clapp 1973; Amerson et al. 1974; Clapp and Wirtz 1975; Kittinger et al. 2011). One record discussed above (Damon 1872) specifies a large take of hawksbill for tortoiseshell trade, a known

historical commercial practice in Hawaii (Bryan 1915; Kittinger et al. 2011). If abundant harvests of unspecified turtles were historically common in the NWHI, and definitive hawksbill records exist historically, then historical harvests probably contained hawksbills. Third, the lack of records should not be surprising given the lack of monitoring. After all, acoustic monitoring in the NWHI only recently (Johnston et al. 2007) identified the area to be wintering range for humpback whales (*Megaptera novaeangliae*).

In summary, the data reported here indicate that hawksbills: 1) currently occur in the NWHI, 2) historically occurred in the NWHI, and 3) formerly had more abundant populations. Though our data may have limitations, discounting them may lead to inappropriate conservation planning for species that were previously both more abundant and widespread (Sáenz-Arroyo et al. 2006). Importantly, although these observations triple the existing spatial distribution of the Hawaiian population, they do not resolve its spatial structure. Future monitoring may answer whether the NWHI is strictly a juvenile foraging habitat, for example, or if other population segments also inhabit the area. To this end, a recent satellite track of a post-nesting female hawksbill showed the turtle en route to the NWHI, halfway between Kauai and Nihoa (G. Balazs, *pers. comm.*, February 2012). Given the poor state of knowledge with the status, distribution, and structure of the Hawaiian hawksbill population, we recommend a variety of efforts to increase monitoring, including further historical ecology research, crowdsourcing, satellite tracking, beach monitoring, and in-water surveys. Together this information will increase the scientific understanding and enhance recovery efforts for what may be the most critically at-risk sea turtle population on the planet.

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